BRIDGING THE LIFE SPAN

Technology in the Future of Indiana's Rural Healthcare Providers

A report commissioned by the Indiana State Department of Health
State Office of Rural Health

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Executive Summary

This report was commissioned by the Indiana State Department of Health. It is intended to provide background information and recommendations for advancing the use of telemedicine and other information technologies to enhance access and quality of care available in rural areas of Indiana.

Technology itself is insufficient to bring the benefits of enhanced health care to rural areas. Collaboration must be sought out, encouraged, and practiced. Technological development and collaboration must develop together. Although not all necessary services can be provided through collaborative technological developments, the important comparison is not between the care available via technology-enhanced means vs. the care available in person, but rather between the care available via technology-enhanced means and limited or unavailable care.

Existing Telehealth Resources

Several Indiana health systems have used interactive videoconferencing as a mechanism to promote continuing education and leverage incumbent medical expertise across their provider networks. A wide variety of medical educational programs is available nationwide to enhance continuing education opportunities for hospitals and clinics who have the capability to access these services. The use of videoconferencing technology for live telemedicine has been less widespread in Indiana, but is being investigated by a growing number of providers. The recent adoption of telemedicine as a reimbursable service under Medicaid, along with increasing acceptance from other payers, is expected to increase its use. In addition, recognition of the high level of need and the ability of telemedicine and other technologies to meet at least some of that need will drive further expansion of telemedicine services.

Health Technology Infrastructure Development Plan

Indiana has many unique characteristics that support its ability to bring about rapid development in the fields of telemedicine and health technology development. Broadband network connectivity is the backbone of such infrastructure development because, along with medical expertise, network connectivity supplies the raw materials out of which technology enhanced healthcare services are provided.

A wide variety of technology enhanced healthcare services are poised to be deployed more widely across Indiana. These include several types of store and forward services (including tele-radiology, already widely used), a range of services collectively known as “clinical messaging,” and live 2-way telemedicine using any of several types of videoconferencing technologies.

Some essential characteristics of computer networks influence the types of services available and pricing structures of these technologies. Extensive network connectivity services are available from large commercial telecommunications providers in Indiana.

In addition, several other specialized networks have been developed in Indiana that can provide important benefits to member organizations.

Health providers' current technology assets, including their equipment and staff, acquired expertise, and technology budgets, already provide an impetus toward health technology expansion. Coordination of the efforts of existing organizations will provide key benefits without significant investment of funds. The Indiana Office of Technology has existing contracts for network services that are one way of aggregating and coordinating network services across providers. Networking and connectivity services covered by these contracts are available to public non-profit rural healthcare providers and may provide good value for the specific services covered.

Connecting with Internet2 will become an important goal for healthcare providers interested in adopting more technology enhanced healthcare services, even though few rural providers have current identifiable needs for such a connection. Other existing statewide networks, including the Vision Athena video network, may play important roles in enhancing connections among Indiana's public health offices, schools, medical training institutions, and other healthcare providers.

Many excellent example of how statewide public agencies can support the development of health technology are available. Among these are the Illinois Critical Access Hospital Network (ICAHN), the *Link Michigan* plan, the Arizona State Public Information Network (ASPIN), and the Iowa Communications Network (ICN).

Specific Recommendations

Six goals and 17 objectives are presented to advance Indiana's health technology infrastructure.

GOAL 1: Coordinate statewide health technology development efforts.

Objective 1.1: Establish an oversight group with members representing a broad range of health technology stakeholders, and charge this group with evaluating, adapting, implementing, and extending the plans in this report.

Objective 1.2: Establish or support a group, separate from the oversight group, that can provide technical information, coordination of efforts, political advocacy, and professional networking for people working to promote telehealth and telemedicine services throughout the state.

GOAL 2: Promote greater use of existing connectivity resources.

Objective 2.1: Promote more widespread use of the federal Universal Service Fund program by rural healthcare providers through informational campaigns, technical assistance, or other means.

Objective 2.2: Examine the benefits of more widespread use of existing state contracts between the Indiana Office of Technology (IOT) and telecommunications providers to supply data transport and Internet access to public non-profit healthcare providers.

Objective 2.3: Conduct more research into successful programs implemented in other states to improve healthcare connectivity.

GOAL 3: Leverage Indiana's incumbent resources to expand health technology and services.

Objective 3.1: Establish an aggregate Internet2 membership for Indiana healthcare providers.

Objective 3.2: Leverage Indiana University expertise to explore possibilities for developing a regional system for aggregating both commodity Internet access and Internet2 connectivity.

Objective 3.3: Develop a specialty telemedicine network based at the eight Indiana University School of Medicine residency training sites across the state.

Objective 3.4: Work with the Indiana Economic Development Corporation (IEDC) and other local economic development efforts to support and encourage the implementation of telehealth technologies in on-site primary care clinics.

GOAL 4: Promote uniform connectivity models for healthcare providers.

Objective 4.1: Develop a list of recommended services and recommended network connectivity levels for rural healthcare providers.

GOAL 5: Better integrate public health priorities into health technology development efforts.

Objective 5.1: Explore the possibility of collaborating with the Department of Education to either acquire and modernize or better utilize the Vision Athena fiber optic video network.

Objective 5.2: Explore the possibility of collaborating with existing Disaster Preparedness and Bio-Terrorism initiatives across the state to coordinate emergency communication and clinical care networks.

GOAL 6: Support the development of new health care services, targeted at shortage areas, through new and existing programs.

Objective 6.1: Support efforts to simplify the negotiation and setup process for new telemedicine or telehealth specialty providers, especially small independent providers.

Objective 6.2: Develop or expand health educational programs that can be delivered via videoconferencing to schools or health clinics.

Objective 6.3: Develop 1-3 school-based telemedicine clinics.

Objective 6.4: Develop or support 1-3 model implementations of virtual primary care clinics focused on improving access for minority populations or residents of health provider shortage areas.

Objective 6.5: Promote efforts to connect existing diagnostic facilities at rural hospitals (echocardiogram, electroencephalogram, sleep centers, etc.) with qualified specialists in other communities.

Objective 6.6: Explore options for providing remote IS/IT management and consulting services for Critical Access Hospitals and other rural providers, similar to what the Illinois Critical Access Hospital Network provides.

Objective 6.7: Continue to explore the use of telehealth technologies in correctional facilities.

Introduction

This report was undertaken at the request of the Indiana State Department of Health for the purpose of gaining a better understanding of the ways in which current technologies, especially broadband networking and the use of telemedicine, can enhance access and delivery of quality healthcare in rural Indiana.

In the Plan for Community Health Improvement 2004-2007, published by ISDH in 2004, a diverse group of stakeholder expressed their goals for infrastructure development that would enhance the health and healthcare of residents in rural Indiana. That report noted that Indiana has historically ranked toward the bottom of the list of states in per capita spending on public health, numbers of public health workers per capita, and educational qualifications of public health workers. Among the most important goals listed in that report are those that target improving surveillance capacity, building greater collaborative relationships among health providers, schools and other agencies with educational missions, increasing access to culturally competent care, and enhancing public health educational opportunities in areas of chronic disease care, self-management, smoking cessation, and other health issues.

Many of these goals are intimately related to the development of a physical and digital infrastructure that supports the interactions necessary to build such collaboration. As connections between providers, communities, and regions improve, distance becomes less of a barrier to improving lives.

Connections themselves, however, are not sufficient to bring enhanced health care to rural areas. Novel and innovative forms of collaboration must be sought out, encouraged, and practiced. Many practical matters go into the construction and maintenance of vital collaborative enterprises, and it is by working through practical details that the real potential (as well as the realistic limits) of collaboration is found.

Appropriate technological development is, in general, good for rural communities. It is important to note that technology deployment on its own, however, does not guarantee successful rural development, and a comprehensive understanding of rural needs and capabilities is required to provide the foundation for any new technology.

Some technology enhanced healthcare services are perceived as inferior to in-person care. However, the important comparison in these instances is not between the care available via technology-enhanced means vs. the care available in person, but rather between the care available via technology-enhanced means and limited or unavailable care.

Information and views provided in this document are the result of numerous interviews and conversations with persons involved in healthcare, networking, telecommunications, telemedicine, and other related fields throughout the state. These views are intended to represent a wide variety of concerns and positions, but cannot be assumed to represent all relevant perspectives or the views of the Indiana State Department of Health.

Existing Telehealth Specialty Provider Networks and Resources

As healthcare shortages become more pronounced, it is vital that healthcare providers attempt to leverage available technology to bring the best possible care to their communities. Telehealth applications have allowed many of our nation's rural communities to offer primary and specialized health services that were not previously available. Rural patients have benefited from the improved access and more timely care. Community providers have been able to retain more patients and enhance community perception of their facilities.

A number of telehealth networks are already in operation in the state of Indiana. Two of the major medical providers in Indianapolis, Clarian Health Partners and St. Vincent Hospital, have been consistent leaders in deploying these technologies. Several Indiana health systems have used interactive videoconferencing as a mechanism to promote continuing education and leverage incumbent medical expertise throughout entire networks. Specialty centers have also seen the value of using these connections to enhance referral relationships. With declining federal reimbursement margins and the increase in managed care, healthcare providers continue to seek ways to develop and improve their patient and procedural mix. Developing a greater local presence in nearby rural markets helps regional medical centers expand their traditional referral areas.

Using videoconferencing technology for telemedicine or tele-consultations has been less widespread in Indiana, but is being investigated by more providers. Until recently, the absence of Medicaid reimbursement in Indiana and the reluctance of other payers to compensate tele-consultations was a major barrier to widespread adoption. The Riley Connections program, now a part of Clarian Telemedicine, was the first telemedicine program to provide clinical consultations in multiple pediatric specialties. This program began with the help of a grant from the HRSA Office for the Advancement of Telehealth (OAT) and has been in continuous operation since 2004.

Since that time, other providers have joined the telemedicine market and are providing a wide range of services. The first section of this report includes an inventory of existing telehealth providers, educational resources, and other applications available in the state of Indiana. The report categorizes specific educational and clinical services available by provider. In the second section, Indiana's rural healthcare technical and connectivity resources are reviewed and strategies for supporting the deployment of telemedicine specialty networks and the connectivity resources they require are proposed and discussed.

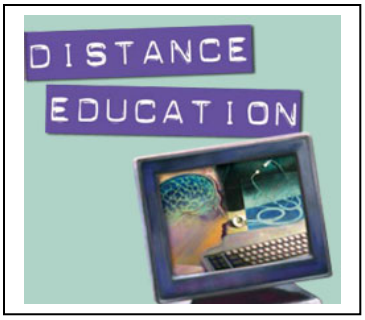
Telehealth vs. Telemedicine

It is important at the outset to differentiate between telehealth and telemedicine. Telehealth is a more general term used to describe any video communication used for medical education, public health education, or communication supportive of clinical care.

Telemedicine is more specifically used to describe such communication that involves both a patient and a provider and is the type of interaction that medical professionals would traditionally bill for. Sometimes it is intended to include specific store and forward services such as tele-radiology. Real-time intensive care monitoring, provided by off-site intensivists, also qualifies as telemedicine. Other services such as diabetes education or nurse teaching sometimes fall into both categories. One key distinction is whether the interaction is among healthcare professionals (telehealth) or involves direct interaction with a patient (telemedicine).

Tele-education Offerings

Clarian Health Partners – Clarian Telemedicine



Clarian Health broadcasts a variety of regularly scheduled live educational events to partner facilities (see Appendix A). These broadcasts cover a wide range of clinical departments including pediatrics, cardiology, oncology, and palliative care. Because some events are accredited as Indiana University Medical School Continuing Medical Education (CME), remote attendees can obtain CME credits for participation. Participants are required to sign in and fax a certificate of attendance to the IU CME office. Because most individual practitioners have employer imposed educational credit requirements, this program allows them to stay current with their education while reducing travel. This is especially convenient for rural providers who do not have access to other local medical education programming.

One of the most popular offerings in the Clarian program is Pediatric Grand Rounds. This event originates from Riley Children's Hospital Outpatient Auditorium (ROC) every Wednesday morning. Pediatric specialists speak about specific conditions or treatments and pediatricians and other clinical personnel can listen and interact with the presenter. The telehealth network allows pediatricians across the state the opportunity to visit a partner (spoke) site and remotely attend the presentation. Since the broadcast is interactive, remote participants can also ask questions just like the Riley audience.

Other clinical departments at Riley Children's Hospital offer video feeds from their weekly case reviews. The Pediatric Cardiology and Oncology groups currently broadcast patient case reviews to physicians from referring hospitals. Referring providers appreciate the chance to participate in treatment discussions involving their patients. These conferences help partners build trust in each other and encourage better communication and collaboration. They also allow referring physicians to stay more connected with their patients and can strengthen long-term care collaboration between facilities.

St. Vincent Hospital

With the help of a Rural Hospital Flexibility Program (FLEX) grant through the Indiana State Office of Rural Health, St. Vincent Hospital in Indianapolis developed a web-based medical education tool. This service allows medical professionals located virtually anywhere to remotely log in to a web site and pick from a menu of clinical education programs. Using video streaming technology, clinicians can view pre-recorded events at their leisure. The only requirement is that the viewing location have an adequate broadband connection to support streaming video (DSL or higher). The application can be found at https://secure.stvincent.org/distancelearning/default.aspx

Users need to register and create a user account to have access to the programming. The site also contains educational resources for non-physicians such as EMS personnel, nurses, and human resources staff.

St. Vincent also delivers live medical education to partners, including six critical access hospitals located around the state. High bandwidth DS3 lines to all six of these partner hospitals provide ample bandwidth to support live video communication. Below is a picture of the video equipment located at St. Vincent Clay hospital in Brazil and is representative of other St. Vincent partner locations. The integrated room design in Brazil provides a good model of a well designed and useful videoconferencing facility.

National Programming

Because of the global reach of the Internet, geography has ceased to be a barrier to obtaining medical information. Many well known medical institutions and universities offer extensive medical educational programming via secure or public web sites. Like the St. Vincent service, users can create accounts and log in to view programming of their choice. Below are links to a few of the national programs that offer some form of free web based programming. There are also a significant number of fee-based programs available offering individual and institutional subscriptions and per-use billing.

The University of Arizona has a collection of prerecorded CME events that can be viewed at:
http://video.biocom.arizona.edu/video/videolibrary/pedsGR/default.htm

The American Academy of Family Physicians (AAFP) has an online CME center where physicians can view pre-recorded events:
http://www.aafp.org/online/en/home/cme.html

There are also web sites, like the Virtual Lecture Hall, that offer CME credits and a catalog of courses for a fee:
http://www.vlh.com/

Clinical Messaging

Bloomington E-Health Collaborative

The Bloomington E-Health Collaborative (BEHC) is a community-wide clinical messaging initiative currently being developed by Bloomington Hospital and other healthcare organizations in Monroe and surrounding counties in South Central Indiana. Like many other clinical messaging projects, this effort focuses on improving safety and quality of health care by coordinating the use of health information technology across providers in a geographic area. It is similar to many organizations around the country called Regional Health Information Organizations (RHIOs).

The initial projects will leverage existing clinical information systems at the participating organizations to provide global community benefit. BEHC already has a successful project providing improved access to laboratory data via the Bloomington Hospital provider portal. The group intends to represent community-wide stakeholder interests to ensure that the requisite infrastructure is developed and maintained to support a fully integrated electronic health care delivery system and automated health information exchange. More information on the BEHC is available at http://www.behc.org.

Telemedicine Providers

Clarian Health Partners - Clarian Telemedicine

http://www.clariantelemedicine.org

The Clarian Health Partners Telemedicine program began with a grant awarded to Riley Children's Hospital from HRSA's Office for the Advancement of Telehealth. The initial deployment, called Riley Connections, was the first program in the state to provide live telemedicine consultations in a number of different pediatric subspecialties. The program was adopted by Clarian and has since expanded into adult medicine. The program has provided over 600 live telemedicine consultations in adolescent psychiatry, dermatology,

urology, endocrinology, pulmonary care, and others. The program is also routinely used for diabetes education and training for patients and their extended families.

The Clarian telemedicine program also facilitates store and forward telemedicine and the transfer of electroencephalographs (EEGs) and sleep studies. Since the knowledge base required to read pediatric EEGs is highly specialized, many Indiana communities lack providers with the expertise to interpret these specialized studies. Patients needing such services are typically referred to a metropolitan specialty provider. With dedicated T1 telecommunications links, Clarian Telemedicine partner facilities can perform the EEG onsite and transmit the digital study to a pediatric neurologist located in Indianapolis. This service has reduced turnaround time for EEG reads in these communities from a matter of days to a matter of hours.

St. Vincent Hospital

St. Vincent Hospital utilizes telemedicine to provide behavioral health consultations to partner sites within the hospital network. Behavioral health specialists at Saint John's Anderson Center in Anderson, IN have been providing tele-mental health consultations to outpatients located at St. Vincent Mercy in Elwood, IN since 2004. Over 200 patient consultations have been conducted since the program's initiation. The program has also delivered tele-consultations to patients located at St. Vincent Randolph Hospital.

St. Vincent's is also using telehealth technologies to enhance the services provided by their home health division. Telemedicine applications in home care have been one of the fastest growing applications and multiple published studies are now available documenting the improvements in quality of care and reductions in cost of care. St. Vincent is conducting their current study in partnership with the Purdue Regenstrief Center for Healthcare Engineering. The pilot study, involving 60 patients, is focused on improving treatment for patients with congestive heart failure. Results from this study are expected to promote the use of this technology in the home care setting. St. Vincent is also evaluating a pilot project which would enhance the provision of obstetrical care at a partner facility in Frankfort. This program, scheduled for rollout in 2007, will allow remote site fetal heart rate monitoring and improved access to obstetrical specialists.

Community Health Partners

Community Health Partners is now using telemedicine consultations to improve their emergency department's delivery of mental health services. Getting mental health consultations in the emergency department (ED) has been an ongoing challenge for many hospitals. Because of widespread shortages of behavioral health specialists and the large fluctuations in case volume, it is difficult for hospitals to provide consistently adequate staffing, especially during evening and nighttime hours. At those times when a behavioral health on-call specialist is not available, extensive delays in the ED are likely and further costs may be incurred by the need to provide necessary holding areas.

Instead of staffing the mental health professionals at each hospital, Community Health Partners is using video consultations to deliver the services of a centralized specialist to all of the facilities in the network. This virtual coverage allows member hospitals to better triage patients and saves time when determining best treatment options. This system, in operation since second quarter of 2006, is currently being employed between the Community North and Community South campuses. To date, the service has been used for at least 50 patient consultations and has helped to avoid several expensive ambulance transfers.

St. Francis Hospital

St. Francis Hospitals and Health Centers, based in Beech Grove, are currently implementing a Baby Wellness Program that will aim to improve the care of newborns. The system will enable live video connections between an OB/Gyn Physician at the Beech Grove campus and three other St. Francis Hospitals in Indianapolis, Mooresville, and Plainfield. These video appointments will allow nurses and nurse assistants at these hospitals to consult with the off-site OB specialist. Diagnostic-grade cameras will allow the OB physician to visually assess the newborn and have real time communication with the extended family members. This service will provide the regional hospitals and patients with OB specific expertise that was not previously available. This service may help families avoid additional physician visits and may help the network better manage patient flows, ultimately leading to fewer patient transfers.

VA Medical Center

The VA has been a longtime national leader in using telemedicine to care for US veterans. At a local level, the VA Medical Center in Indianapolis has used telemedicine extensively to monitor home-based patients. With established low bandwidth telecommunication links (like telephone lines), nurses can remotely monitor patients' vital signs without physically visiting their homes. The program, in operation since 2001, has served approximately 800 veterans since its inception. Care groups include patients with diabetes, congestive heart failure, COPD, hypertension, and those in need of palliative care. The program has resulted in improved diabetic control and blood pressure management and significant reductions in hospitalizations for CHF and COPD patients.

The VA has also received national recognition for their Diabetic Eye Screening program. This service allows patients to visit remote clinics for retinal imaging and has resulted in a 93% reduction in the amount of travel required to Indianapolis. These solutions require very little infrastructure investment while still delivering the full benefits of traditional telemedicine and reducing the frequency of on-site care. The Indianapolis VAMC is also planning to use telemedicine to deliver mental health and dermatology consultations in the next year.

Lugar Center for Rural Health

The Richard G. Lugar Center for Rural Health (formerly the Midwest Center for Rural Health) has a distinguished history of serving rural communities through research and training of rural healthcare providers. The Lugar Center has operated a store and forward telemedicine program called RuralConsult.com for several years. This unique program allows physicians anywhere in the state to post clinical questions, including digital pictures if appropriate, and have remote specialists reply with informal consultations. With over 150 enrolled users, the program has facilitated over 370 consultations since inception and has utilized specialists in the fields of dermatology, obstetrics, gynecology, neurology, gastroenterology, geriatrics, clinical toxicology, endocrinology, pediatric neurology, pediatric endocrinology, and pediatric cardiology.

The Lugar Center is also currently involved in a FLEX funded project developing and evaluating a tele-mental health clinical evaluation and treatment service between the Hamilton Center, a comprehensive community mental health provider in Terre Haute, and the Vigo County Jail. Urgent evaluations and tele-mental health care will be available to inmates at the jail on a regular schedule provided by clinicians at Hamilton Center via telemedicine. An additional aspect of this program is the provision of emergency mental health evaluations in the Emergency Department at West Central Community Hospital in Clinton. These evaluations will also be provided by Hamilton Center, but local follow up will be provided at the nearby Hamilton Center satellite office rather than via telemedicine.

Intensive Care Telemedicine (eICU)

A number of health care organizations across the country, including Parkview Health in Fort Wayne and Clarian Health Partners in Indianapolis, have begun employing intensivists to remotely monitor ICU beds at a number of sites from a centralized location. In this scenario, telemedicine allows off-site intensivists to remotely monitor multiple patients at different locations from a single command center while maintaining regular communication with ICU nursing staff via video cameras and monitors in patients' rooms. The eICU care team uses software alerts to track patient vital trends and intervene before complications occur. According to one provider of these systems, studies have shown that this type of care model can reduce ICU mortality by 25% while simultaneously cutting costs. Along with Clarian and Parkview, several other Indiana providers are evaluating this application.

A complete listing of telemedicine providers and services provided can be found at the end of this report in Appendix C.

Health Technology Infrastructure Development Plan

Indiana is in many ways a cross-sectional sample of American society. It is a mix of large, multicultural urban centers and expansive agricultural and undeveloped rural areas. Its cities are home to some of the finest and most technologically advanced medical centers in the world, while some of its rural hospitals can only connect to the outside world via telephone lines, fax, and Internet connections barely faster than dialup.

Broadband connectivity is the centerpiece of any plan to bring greater healthcare access to rural areas. It is the foundation for the ability to provide services at a distance and share medical information with specialists in remote areas. It is unlikely that demographic and healthcare utilization patterns will change and bring more specialists to rural areas of the country. However, it is possible that through the prudent and aggressive use of technology to coordinate synergistic efforts on the part of both urban and rural providers, greater access to specialists can be provided to more remote areas of the country.

Indiana has many unique characteristics that support its ability to bring about rapid change in the fields of telemedicine and healthcare integration. It is home to some of the most respected and influential centers of medical technology in the world. Among these are the Regenstrief Centers at IU and Purdue, and the Global Network Operations Center for Internet2 (and several other global networks) at Indiana University in Indianapolis. In addition, Indiana has extensive dark fiber assets already in place throughout the state, enabling several existing statewide high speed networks and making possible the economical establishment of others.

The Role and Importance of Technology

Despite a large number of world class hospitals and technology centers, Indiana still struggles to provide adequate access to specialty care for its rural citizens. Most of the state's 92 counties are designated as either partially or entirely rural areas. These rural areas are home to 35 critical access hospitals and 52 rural health clinics. Although these facilities provide excellent primary care and critical emergency services for their local communities, access to specialty care, including trauma, surgery, mental health, and many others, is limited. Most specialists who operate offices in these areas drive in for part-day or part-week clinics, and urgent specialty care may be almost entirely unavailable.

Technical solutions will not eliminate or fully address this problem. Many specialties are not currently amenable to remote extension via current telehealth and telemedicine technologies. Others can only provide partial or follow-up services remotely. However, a significant portion of specialty care lacking in rural areas is amenable to remote provision via telemedicine. Many specialties that cannot be provided entirely via telemedicine can nonetheless be augmented with follow up care provided via

telemedicine, if necessary clinical and informational supports are in place. As stated in the introduction, the important comparison is not between the care available via telemedicine vs. the care available in person, but rather between the care available via telemedicine and limited or unavailable care.

Technologies for Enhancing Rural Healthcare

Healthcare is a field that is ambivalent about technology. On the one hand, technological advances in clinical care are rapidly assimilated into standard practices, especially if the business case exists for doing so. On the other hand, many business management technologies that are commonplace in other sectors are not immediately appreciated in the medical world. Hospitals frequently find themselves spending large proportions of their capital budgets on equipment for clinical use, but lag behind other sectors (and many analysts' recommendations) in general office technology spending.

Improving access to quality care for Indiana's rural residents will not be possible with a simple influx of capital spending on technology. Rather, focused and coordinated action from multiple stakeholders will be necessary. Key to organizing this coordinated effort is a shared understanding of the potential of various technologies and how they may or may not meet perceived needs among healthcare providers and consumers.

The following section provides an overview of several important technology-enhanced clinical services that can be developed and incorporated into the continuum of care currently available in rural areas.

Store and forward telemedicine consultations

The simplest and oldest form of telemedicine is the provision of informal consultations via electronic messaging. With this technology, providers can present descriptions of cases (with or without digital images) to remote specialists and get diagnostic or treatment recommendations. Although some such consults have been conducted via standard (unsecured) e-mail and the public Internet, most are currently provided over encrypted connections.

Traditionally, consultations employing store and forward technology have tended to remain at the informal level, since few appropriate billing options were available to support the provision of direct clinical services and formal billing for consultations. However, more recent developments, especially in the support of preventive and primary care services to HMO members, have made billing for store and forward services a little more common. Alaska and Hawaii are two states that have formal reimbursement policies for store and forward telemedicine through a pilot program with CMS.

Tele-radiology (discussed in detail below) is perhaps the best known and most successful form of store and forward telemedicine. Other specialties that rely on visual image

information, like dermatology and pathology, are also very amenable to store and forward consultations. Some newer developments include store and forward consults for forensic exams in cases of alleged rape and mental health treatment plan reviews.

Secure Clinical Messaging

Secure clinical messaging is an extension of store and forward telemedicine to include more aspects of standard electronic messaging and encompass a wider range of clinical and reporting services. While most clinical messaging applications allow for standard secure personal messaging (like e-mail) with image attachment, they also extend those capabilities by providing access to other stored patient information and the automatic provision of "ticklers" via standard e-mail when new information is available (like new laboratory results or changes in vital signs at a recent check-up).

In addition to giving providers access to patient information, clinical messaging systems often support common patient-driven communication tasks like scheduling appointments and requesting prescription refills. Some systems also have patient health record capabilities that patients can access. Patient health records are patient-entered health information records that allow patients and their providers to keep track of standard information (like immunizations) or monitor important health parameters (like weight or blood pressure) without appointments.

Because these records are entered by the patient, they differ from physician records in important ways. They can be made more easily accessible to patients, and if fact are often encouraged for teaching patients better self-management skills for chronic diseases. As a side-effect, physicians, nurses, and disease managers get useful information tracking changes in important parameters on a daily or other regular basis.

In general, clinical messaging systems do not require dedicated networking connections between facilities. A central server, located either at a hosting facility on the public Internet or at a clinical site, houses the messages and patient information. Users access the server through a secure web browser by providing a username, password, and other credentials as necessary. Messages remain on the server and are viewed and managed through the browser over the encrypted connection. In this way sensitive patient information can be accessed without it ever leaving the central server or entering the public e-mail system.

Tele-radiology

Tele-radiology is currently the most successful and widely used telemedicine application. Any type of radiological image can be captured as a digital image or converted to digital from traditional hard copy film. Once in digital form, the image can be transferred as simply as any other file type using any kind of electronic messaging system. In the case of tele-radiology, however, the need for security in transferring the images, the range of

possible file types, and the sheer size of some radiological images make the transfer of these files much more complicated at a practical level than a simple file transfer.

To manage this complexity, picture archiving and communications systems (PACS) were developed. These systems support a range of digital image file types, allow for storage, retrieval, viewing, searching, and marking up digital images, and manage the secure transfer of images to remote sites for reading and reporting. Web based versions allow physicians to remotely dial into central servers to view their patients' images from any accessible location. Not all PACS systems are web enabled, however, and this functionality comes with additional cost. It is difficult for rural facilities to obtain comprehensive PACS systems because of the complexity and integration costs (both initial and ongoing) of such a system.

Live Interactive Telemedicine

Telemedicine is the provision of clinical services at a distance. Most practical definitions of telemedicine include the concept of a real time interactive video connection such as is available using commodity videoconferencing equipment. These interactive video sessions can support a wide variety of medical services, including many specialty services.

Providing and managing telemedicine services is similar to providing in-person medical care in many ways. Patients can be scheduled by the specialist's staff or at the referring site, and billing and payment can be handled very similarly to regular medical care. Special arrangements usually need to be made for the generation, storage, and retrieval of medical records and other documents between sites. Cashiering can also be a problem that needs special attention.

Live interactive telemedicine generally involves the development of referral and coordination relationships between two providers (hospitals, clinics, specialists' offices, etc.) and the installation of equipment suitable to support the videoconferences. A wide range of connectivity speeds and equipment can be used to support this service. Support staff are generally used on the patient side of the consultation to establish the connection, room the patient, and provide background information to the remote specialists as necessary. Medical providers at the patient site may also attend the consultation for some or all of the appointment as necessary. Consultants, if they are to bill for the service, are responsible to keep accurate records of every encounter, and generally send copies or summaries to the referring providers. Often consultants provide information and recommendations and allow the referring provider to maintain the central prescribing and management role.

Table 1 briefly summarizes the most useful technologies for remote medical service provision and the types and network connections and other equipment or expertise necessary to support them. The table also includes information on the penetration of the technology; that is, how widespread its use is currently among rural providers. This gives

some idea of how quickly a new service that relies on a specific technology could be adopted and how widespread its use might be. As with all computer-related technologies, utilization rates for the technologies listed in the table are likely to change, possibly in dramatic fashion, over the next 3-5 years.

As the table shows, using technology to improve health care through enhanced access to specialists is possible across a range of levels of network connection speeds and technical sophistication. In general, policies and programs that can leverage the entire gamut of available technologies are more likely to make significant impact across the broadest range of rural providers and specialties.

Legal Issues

Current law prohibits some financial arrangements that might otherwise seem reasonable for developing and supporting telemedicine. This is because of the concern to avoid influencing the flow of referrals among providers based on financial incentives. The laws that impact financial arrangements for general medical care also apply to telemedicine. Two of most important are the Medicare-Medicaid Patient Protection Act (also known as the "anti-kickback" statute) and the Stark laws. The Medicare-Medicaid Patient Protection Act makes illegal any arrangement where one purpose is to offer, solicit, or pay anything of value in return for a referral for treatment or services provided to Medicare, Medicaid, and state program patients. The Stark laws forbid the referral (except in certain “safe harbor” situations) of patients to clinics or services in which the referring provider has a direct financial interest. More information about these and other laws affecting telemedicine can be found at the references listed at the end of this report.

These laws make it illegal for medical providers to “split fees” or use other types of financial arrangements designed to spread the costs of telemedicine consultations across both the hub and spoke sites, because such arrangement can also be construed as meeting the definition of referring to an entity for in which one has financial interests or providing a kick-back (e.g., telemedicine equipment) in exchange for referrals. In effect, these laws forbid the practice of one hospital or provider giving technology (or anything else of value) to another provider as a way to increase the latter’s access to specialists at the former site. Such access is often seen as the very reason to develop telemedicine capabilities. These and other regulations that affect the implementation and spread of healthcare technologies are undergoing scrutiny as many health care organizations are seeking ways to increase both their investment in communications technologies and their use of technology to improve connections and access to specialty care.

Technical Considerations

Computer networking technologies that were developed alongside computers themselves throughout the last few decades form the foundation of the current connectivity infrastructure. Where electrical power and analog telephone lines were the first utilities

to span the country, now computer networks have been established alongside, and even sometimes in place of, those earlier technologies.

These computer networks differ in fundamental ways from the analog telephone networks they are quickly replacing. They have tremendous information carrying capacity, but that capacity can be parceled out into arbitrarily sized units and divided among many users. In contrast to traditional telephone lines, where each connection was one continuous electrical circuit that was used to capacity by a single telephone call, modern computer networks carry multiple streams of digitized sound, video, and computer data over the same channel. Methods of routing, multiplying, combining, and separating these data streams have been developed to ensure privacy, encrypt communications, increase data carrying capacity, and allow for more precise billing for transport costs.

Almost all newer wide area network installations use fiber optic transmission lines. Because the signal carrying capacity of fiber is so high, the capacity or speed of a fiber-based network is as much a function of the hardware connecting the fiber as it is of the fiber itself. "Build out," which is a term used often in networking and telecommunications circles, refers not only to the process of laying physical wires or fibers in the ground, but also to upgrading the equipment used to connect those wires or fibers so that the network can handle more traffic over the same connections.

Networking and telecommunications providers aggregate data traffic from their customers to take full advantage of the capacity of their networks. Computer networks are constantly carrying traffic from multiple sources bound for multiple destinations. Networking companies have developed technologies to ensure greater security and privacy for data traveling over these shared networks. Finally, like in other businesses, economies of scale begin to accrue when a network gets to be very large (that is, when it is required to carry a large amount of data) regardless of whether it covers a large geographical area or not.

Data transport vs. Internet Connectivity

Computer networks connect two or more sites for the purpose of sharing computer data. Connectivity providers quote this type of service as a "data" service, meaning that the network is simply connecting two or more points together to share data. The capacity or "bandwidth" of that data connection and the distance it spans will usually contribute to the cost of such a connection.

Table 1. Technical requirements for various health technologies.

Technology	Benefits	Minimum Requirements	Example	Penetration
Store and forward consultations	Electronic "curbside consultations," sharing pictures or clinical descriptions with remote specialists, receiving treatment recommendations	Any Internet connection, browser/e-mail	Ruralconsult.com	Few providers; potential use by any clinic or hospital
Clinical messaging	Online patient scheduling, refill requests, lab reports, communication with other providers, including "curbside consultations," etc.	Any Internet connection, browser/e-mail, and server + software or subscription costs	Relayhealth.com Medem.com Salu.net Medfusion.net	Few current users; potential use by almost any clinic or hospital
Tele-radiology	Remote reading of radiology images	Digital image acquisition system and any Internet connection, but practically T1 (1.5 Mbps) or better (see Table 2 for speed/time comparisons)	Kodak Carestream Hipax Fuji Synapse	Most hospitals have or are acquiring connections and equipment
Live Telemedicine via standard 2-way Videoconferencing	Standard business-quality video-conferencing, suitable for patient encounters	768 kbps connection or better, standard videoconferencing equipment	Polycom Tandberg Sony	Most hospitals have connections, a few have equipment
Live Telemedicine via proprietary Videoconferencing	Enhanced quality videoconferencing	1-4 Mbps connection, specialized equipment and installation	Cisco LifeSize	Some hospitals have connections, very few have equipment
Live Telemedicine via Digital Video Transport System	Extremely high quality, low latency videoconferencing	30 Mbps connection or T3/DS3, commodity video cameras, computers, and monitors; free software	Internet2/DVTS	Few hospitals have connections, few have equipment

Table 2. Comparison of file transfer times over common network speeds.

Type/Speed	Dial-up (56 kbps)	T1 (1.5 Mbps)	T2 (6 Mbps)	T3 (44.7 Mbps)
10 Mb	23 min	52 sec	13 sec	1 sec
100 Mb	3 hrs, 52 min	8.7 min	2.2 min	17 sec
1 Gb	38 hrs, 45 min	1 hr, 27 min	22 min	1.7 min
10 Gb		14 hrs, 28 min	3 hrs, 42 min	29.5 min

Access to the Internet, with its potential to connect a local computer to any networked computer in the world, is a special kind of data connection. Access to the top tier of the worldwide computer network hierarchy is controlled by a few member companies (a full list can be found at http://en.wikipedia.org/wiki/Tier_1_ISP), so all other companies and networks must pay (or make some type of settlement arrangements) for their connections to this "Tier 1" group. Most packets that do not stay within a single organization's network must travel over the connections between Tier 1 providers at some point in their transit, so access to this Tier 1 "backbone" is essential. The ability to send and receive packets that must travel across the Tier 1 backbone, along with some additional supporting services, is what is commonly known as Internet access, or "commodity" Internet access (in contrast to Internet2 membership or access).

This arrangement is somewhat like a city carved into sections by rivers with several privately owned bridges spanning the rivers. The owners of the bridges have agreed to allow each others' cars and trucks to cross toll free, but anyone else wishing to travel or transport goods to other parts of the city must pay one or more of the bridge owners for the privilege.

AT&T, Verizon, and Sprint are all Tier 1 Internet providers. Other Internet service providers (ISPs) must purchase access from one or more "upstream providers" and in turn sell it to "downstream users" in measured quantities based on bandwidth. This "metered access" is the basic model of consumer access to the Internet.

Alternative Public and Private Networks

Private or alternative computer networks allow companies that aren't part of the core infrastructure of the original Internet to create their own connections and save the costs associated with paying for metered connectivity. These groups build or lease direct physical connections (copper wire, optical fibers, or wireless connections) between member sites. They pay leases on the physical infrastructure and may also pay for network management services, but do not have metered connections or pay based on usage. The I-Light network in Indiana is one such network focused on connecting centers of higher education across the state.

The benefit of such public or consortium-driven networks is not just connectivity, which could easily be purchased in large blocks of metered access from commercial network providers. Rather, these networks bring economies of scale and consortium control over the networking infrastructure. When the physical networking layer (the fiber connections and associated hardware) is controlled by the customer, the full capacity of the network can be utilized and the availability of the network for novel, large scale, experimental, or public benefit uses can be perpetually assured. If access to other networks, like the original Internet, is needed, it can be purchased collectively by the entire network based on the aggregate usage needs of all members of the network, often resulting in considerable savings.

Indiana's Existing Technology Resources

Healthcare Providers

The most significant connectivity resource Indiana's healthcare providers have is their own current connections, infrastructure, and support staff. This may seem obvious, but it is important to recognize that each hospital, clinic, or physician office has an internal need for connectivity and some amount of resources set aside to meet that need. They have made arrangements to meet their own connectivity needs, and many have a plan to expand their connectivity resources as it becomes necessary. Many sites are anticipating rapid increases in bandwidth needs over the next decade as more and more network-intensive technologies become common, even standard, in healthcare. A technology plan that does not directly address the self-perceived needs of Indiana's healthcare providers and take into account the significant resources these providers bring to the table is not likely to succeed.

Telecommunications providers

The primary providers of network connectivity are the large telecommunications companies like AT&T, Verizon, and Sprint. These companies control large, high-capacity networks across the country, and provide most of the upstream connectivity for local telephone companies and network providers. They also contract with local telephone and networking companies to arrange for "last mile" connections to homes and businesses.

Because of their dominant positions, the large telecommunications companies are able to provide innovative and high quality services and offer significant pricing incentives to high volume users. In addition, because of the size of their networks, they can usually provide connections across the state from entirely within their own network infrastructure. This allows them near-total control over the quality and security of these connections.

MPLS (multi-protocol label switching) is an increasingly popular value-added networking service available from many networking providers. First developed by Cisco, a company that makes packet switching networking equipment, MPLS expands the packet labeling system used in packet-switched networks to include further layers of labels in addition to those specified in the original Internet protocol (IP) specification. These additional layers of labels allow a packet to be routed to its destination more efficiently and with greater security. If a single company controls all the "hops" between two destinations, the MPLS service allows for guaranteed secure delivery of the packet without its original contents having been examined at each hop along the way. In this way MPLS improves transit speed and network capacity while providing the ability to configure "virtual private networks" for groups of customers that are an economical alternative to private lines.

The Indiana Office of Technology (IOT) has existing contracts for volume purchasing of network connections for both data and internet connections. Eligible entities can purchase various levels of connectivity at established prices that are negotiated by IOT and reflect the anticipated volume of the contract. According to representatives from IOT, these contracts

extend to public non-profit healthcare providers in the state. Services and pricing are available through this contract that may be significantly better than what many healthcare providers are able to find from their local telephone, cable, and Internet companies.

CILC/Vision Athena Network

The Vision Athena network is a fiber optic network that connects about 450 public schools, libraries, and other sites in Indiana. It was developed as a result of the historic Opportunity Indiana rates-for-investment agreement between Ameritech and the state Public Utilities Commission. The network provides high quality video conferencing over a dedicated network using proprietary networking technology. Because of its use of proprietary networking technology from an era before standardization on IP technology, it does not support IP-based network traffic or any services other than multi-way video.

The Center for Interactive Learning and Collaboration (CILC) is a local not-for-profit organization that was formed to manage and distribute funds resulting from the Ameritech settlement. Approximately 30 million dollars (of a promised 150 million) was made available to develop a high bandwidth fiber optic network that was designed to connect K-12 schools and public libraries around the state with educational content materials. In addition to the fiber network, settlement funds were used to purchase high resolution, large screen monitors and additional audio visual equipment at each school connected to the network. Participant sites pay a nominal monthly fee and have access to a defined number of hours of programming per month. Additional services like connections between multiple sites or across multiple “hops” are charged at higher rates.

This network is a significant educational resource that has been used to expose Indiana students to world renowned experts via live video conferences to places like NASA, Adler Planetarium, Albany Institute of History and Art, and Alaska Sea Life Center. Content providers also include some of the major medical providers in Indianapolis and have provided medical experts a channel to help deliver preventive health messages in areas such as obesity and smoking.

The full capacity of this network is not being tapped, and according to former CILC consultant, many partner sites have significant ‘banks’ of unused hours. Additionally, the network is a “single use” system running a proprietary digital format. Although it is built on high-capacity fiber optic cable, it is limited to multi-way video transmission between and among member sites with compatible video equipment. The Indiana Higher Education Telecommunication System (IHETS) provides bridging capability and can transcode video signals from the Vision Athena format into standard Internet protocol (IP) high definition digital signals, allowing a limited number of other sites not on the Vision Athena network or with standard video equipment (not compatible with Vision Athena) to connect with the Vision Athena network.

IHETS

The Indiana Higher Education Telecommunication System (IHETS) is an organization capable of providing network support services for telemedicine applications. Part of the mission of IHETS is to use advanced technologies to increase educational access, enhance instruction, facilitate training, and meet state needs for economic and workforce development. Last year IHETS provided bridging services for 35,000 hours of video conferences (a bridge is needed to allow more than 2 participants to join a video call at the same time). IHETS bridging services also make it possible for organization utilizing different video protocols (IP, ISDN) to communicate with each other. IHETS provides video webcasts in real time, or can encode and archive programs for on-demand viewing by users around the world. IHETS also offers a managed network firewall service which may be very helpful to small health providers without the network security expertise they need to manage video traffic.

Internet2

Internet2 is advanced networking consortium led by the research and education community. Since 1996, this consortium has acquired, managed, and provided for its members the very highest quality networking services. Internet2 provides an extremely advanced, high-speed networking backbone between major cities across the United States and integrates with several similar networks in other countries. The global network operations center (NOC) for Internet2 is located on the campus of Indiana University in Indianapolis, and access points for the network are located there as well. A recent pilot grant program from the Federal Communication Commission sought to promote increased connections between state and regional healthcare providers through supporting healthcare providers' connections to Internet2. Such connections can support very high quality videoconferencing applications and high speed data sharing between a large number of commercial and educational facilities across the country and around the world.

The Internet2 consortium has agreed in principle to allow Indiana's rural healthcare providers to join the Internet2 network as an aggregate group for the cost of a single membership. This is potentially a tremendous value to Indiana providers. It would allow healthcare providers with data connections to the GigaPOP in Indianapolis ultra-high speed connectivity to other Internet2 members. Although there are currently very few locations or applications that can use this level of connectivity, more are likely to develop as academic medical centers, hospitals, and other healthcare organizations begin to utilize and develop this resource.

Other public and private networks

Indiana is home to a statewide network that connects most of the state's centers for higher education with dedicated fiber optic connections. The I-Light network, though exclusively available to educational institutions, includes connections to the IU Medical School and its affiliated residency programs throughout the state. These sites house some of the finest medical educators and clinicians in the country, and could together provide a platform for the

development of very high quality educational services and clinical telemedicine applications. As these programs develop, their ability to support medical education and other telehealth offerings throughout the state will be greatly expanded as more hospitals and other healthcare facilities acquire high speed connections of their own.

Examples of Success from Other States

The Illinois Critical Access Hospital Network (ICAHN) is a not-for-profit 501 (c)(3) corporation established in 2003 for the purposes of sharing resources, education, promoting operational efficiencies, and improving health care services for member critical access hospitals and their rural communities. ICAHN provides group purchasing arrangements and technical assistance to its member hospitals through a variety of programs. One unique program provides expert technical assistance for local and wide area network development as well as virtual private network (VPN) connections to partner and vendor networks, Internet security recommendations, wireless networking solutions, file server installation and upgrades, department structure analysis, and staff training. This kind of support can be a tremendous resource for independent rural hospitals (and potentially other healthcare providers) in maximizing their ability to purchase and utilize available technology.

Several other examples of excellent statewide efforts exist. The Michigan Economic Development Corporation (MEDC) issued the *Link Michigan* plan in 2001 which outlined recommendations to streamline the deployment of advanced telecommunications systems in Michigan. The four-part approach outlined in the plan includes combining statewide connectivity purchases to create a high-speed backbone, implementing taxing and permitting fairness across the industry, requiring documentation and access to information about the existing connectivity infrastructure, and providing funds for public regional connectivity planning initiatives. Among other things, the plan enforces quality of service standards and requires reselling of excess capacity at nondiscriminatory rates.

The Arizona State Public Information Network (ASPIN) not only provides high speed internet access to Arizona's public organizations, but also connects all of the state's K-12 schools. This program has allowed Arizona to bring OC-12 level connectivity (over 600 Mbps) within 10 miles of 90% of its population.

Iowa has developed a statewide fiber optic network called the Iowa Communications Network (ICN). This network provides live distance learning to over 750 classrooms located in schools, National Guard armories, libraries, hospitals, and federal and state government buildings. The network also provides high speed internet access and telephone and data service. More information about this network can be found at: http://www.icn.state.ia.us/

Recommendations

This document seeks to provide a framework for policy, program, and coordination efforts that will allow providers and vendors of healthcare and networking technologies to exercise extensive

and unimpeded independent initiative while specifically encouraging collaborative efforts to provide more efficient, effective, and economical access to healthcare and networking services. Some of these recommendations have already been made in a report published by the Regenstrief Center for Healthcare Engineering entitled "Telemedicine in Indiana." This report is available at http://author.www.purdue.edu/dp/rche/pdf/IndianaTelemedicineWhitePaper.pdf.

Specific Goals and Objectives

The following specific goals and objectives are provided as a starting point for further discussions and as a stimulus for reflection on the range of possible activities that may support and enhance healthcare access, both directly and indirectly, in Indiana's rural communities. It is not intended as an exhaustive list or as a critique, either stated or implied, of any existing programs or initiatives. Some goals may be pursued by ISDH independently while others may require a great deal of coordination and cooperation between state agencies, private companies, and other stakeholders.

GOAL 1: Coordinate statewide health technology development efforts.

Objective 1.1: Establish an oversight group with members representing healthcare providers, telecommunications providers, telemedicine specialists, economic development organizations and others with interest in advancing connectivity among Indiana's healthcare providers. Charge this group with evaluating, adapting, implementing, and extending the plans in this report toward the goal of enhancing rural health care access through appropriate, effective, and efficient use of technology.

A credible and effective oversight group is necessary to guide the development of policies and evaluate possible new directions. This group should meet approximately quarterly to review current plans and milestones, set goals, and evaluate progress to date. Providing stipends, honoraria, or per diems to participating members should be considered to encourage active participation and deepen the pool of available members.

Objective 1.2: Establish or support a group, separate from the oversight group, that can provide technical information, a forum for coordination of efforts, political advocacy, and professional networking for people working to promote telehealth and telemedicine services throughout the state. This group should be composed of members with an interest in promoting telehealth and telemedicine but be independent of any one provider or healthcare group. The Indiana Telemedicine Advisory Consortium is one such group already in existence.

GOAL 2: Promote greater use of existing connectivity resources.

Objective 2.1: Promote more widespread use of the federal Universal Service Fund program by rural healthcare providers through informational campaigns, technical assistance, or other means.

This program can provide a significant reduction in the cost of broadband connectivity for healthcare providers in rural areas.

By definition, critical access hospitals must be in rural areas and qualify for Universal Service Fund telecommunications subsidy funding. A few consulting firms are providing support for hospitals wanting to access these funds, and such access should be encouraged. Providing technical assistance or information to help more healthcare providers access Universal Service Fund dollars will save rural providers a significant portion of their connectivity costs and allow them to consider purchasing higher levels of access than they could otherwise afford.

Objective 2.2: Examine the benefits of more widespread use of existing state contracts between the Indiana Office of Technology (IOT) and telecommunications providers to supply data transport and Internet access to public non-profit healthcare providers.

Some existing contracts appear to provide good value for the individual services they cover. There may be an indirect benefit that accrues to IOT from increasing the volume of these contracts, as it may improve the bargaining position of IOT for future contracts. It is unclear at this point how volume pricing from a state contract would be affected, if at all, if rural sites increase their use of Universal Service Fund dollars.

Purchase of premium networking services such as MPLS, managed virtual private networks (VPNs), or specific videoconferencing services should be carefully evaluated. These services may provide added value to healthcare providers in some situations, such as obviating the need for additional levels of security in a telemedicine session. However, if they do not provide security or quality of service guarantees, or if such services do not actually enhance the security or quality of the user experience, they add little value.

Objective 2.3: Conduct more research into successful programs implemented in other states to improve healthcare connectivity.

Many states have already implemented successful programs that address similar infrastructure needs. All attempts should be made to learn from these systems and leverage best practices, including leveraging large-scale purchasing power, using regional aggregation strategies, and employing targeted public sector investment.

GOAL 3: Leverage Indiana's incumbent resources to expand health technology and services.

Objective 3.1: Establish an aggregate Internet2 membership for Indiana healthcare providers.

Access to Internet2, at a physical level, involves getting the network signals from hospitals to one or more central points of access. At present, the two available access points for Internet2 in Indiana are at the Indiana GigaPOP offices in Indianapolis (2 locations). Most large telecommunications providers will already be able to provide transport of network signals to one

of these sites. Fees will likely be charged for these connections based on the distance from the hospital or clinic to the GigaPOP site.

The Internet2 consortium's offer to allow a single membership to encompass all Indiana healthcare providers is an outstanding opportunity to make this resource more widely available at a very reasonable cost. Connection to Internet2 will allow rural sites to access high quality content from other Internet2-connected medical schools and universities, as well as providing a high-speed connection for videoconferencing between connected sites.

One caveat is that connection to Internet2 is not likely to yield any immediate benefit for Indiana's rural healthcare providers. It is unlikely that there will be significant use of this connectivity by rural providers until more services are available via this network. However, having a connection to Internet2 will eventually be a necessity for all healthcare providers, and unless there is certainty that current costs will not change significantly, it would be advantageous to acquire membership sooner rather than later.

Objective 3.2: Leverage Indiana University expertise to explore possibilities for developing a regional system for aggregating both commodity Internet access and Internet2 connectivity.

Construction of both Internet2 and the statewide I-Light system has brought to IU a wealth of expertise in network design, construction, and management. These networks themselves provide a model for expanding public trust ownership of networking resources that may be replicable within the healthcare domain. It would be beneficial to develop consulting and information sharing relationships with experts at IU for the purpose of gaining insight into how best to expand connections among Indiana's healthcare providers so as to make the most effective use of current and foreseeable developments in Indiana's networking infrastructure.

Objective 3.3: Develop a specialty telemedicine network based at the eight IU School of Medicine regional training sites across the state.

Establishment of a pilot project at these sites with connections to specialists in Indianapolis would provide increased access to specialty care for these areas (some of which are medically underserved; see the full list at http://medicine.iu.edu/body.cfm?id=225&oTopID=225) and serve as a model for integrating telemedicine training into existing medical school curriculums. This would also provide IU medical students with an excellent opportunity to gain exposure to new technology and may provide a recruitment and retention benefit for rural Indiana providers. Incorporating the IUSOM into statewide telehealth initiatives was also proposed by the Regenstrief Center for Healthcare Engineering in their March 2006 report "Telemedicine in Indiana"

Objective 3.4: Work with the Indiana Economic Development Corporation (IEDC) and other local economic development efforts to support and encourage the implementation of telehealth technologies in on-site primary care clinics.

Such clinics can prevent time away from work, increase worker productivity, and decrease the long term costs associated with poor health care accessibility. Large manufacturers such as

General Motors have already expressed their concern that Indiana health costs are some of the highest for any geographical region in which they operate. Statistics such as these make the state unattractive to business development and underscore the need for the state to find creative, proactive ways to improve Indiana's health image.

GOAL 4: Promote uniform connectivity models for healthcare providers.

Objective 4.1: Develop a list of recommended services and recommended connectivity levels for rural healthcare providers. Such a list might include the telemedicine technologies listed in Table 1 as available services with recommendations as follows:

- Rural health clinics are recommended to obtain a minimum T1 level connection (1.5 Mbps), capable of supporting commodity videoconferencing, clinical messaging, and more efficient small data file transfer.
- All hospitals, including rural hospitals, are recommended to obtain connectivity of 30 Mbps or more, capable of supporting multiple simultaneous clinical applications such as high definition/low latency videoconferencing, emergency tele-stroke care, e-ICU applications, and computer software application services. This level of bandwidth will also support quicker routine transmission of medical records, medical claims, imaging files, and general informatics exchanges.

It is recommended that these standards be approached as aspirations of the Indiana health system as a whole. They are a way to gauge the extent to which Indiana can view its healthcare system as being "adequately connected" and able to participate in the benefits of technology-enhanced healthcare. These recommendations should not place significant financial burdens on cash-strapped healthcare providers without making high-value services available over these enhanced levels of connectivity.

GOAL 5: Better integrate public health priorities into health technology development efforts.

Objective 5.1: Explore the possibility of collaborating with the Department of Education to either acquire and modernize or better utilize the Vision Athena fiber optic video network.

This network currently connects about 450 public schools, libraries, and other sites in Indiana. If acquiring and upgrading this network to provide IP services is feasible, it could become an invaluable resource for the state's public health efforts. A modern fiber optic IP network to these sites could not only support integrating Indiana's medical and nursing schools with Indiana's public schools, but would also place Indiana's public health providers in a position to leverage this resource to improve connectivity at many public health facilities in these communities. The existing network is an underutilized resource in its current state. Upgrading it to carry IP traffic would make it far more useful to the sites it already connects as well as to healthcare facilities that could connect directly to such a network.

Even if modernization of the Vision Athena network is not possible, this network in its current form could be used to support:

- Public health programming at public schools (see Objective 6.2)
- Telemedicine specialty or primary care clinics at public schools (see Objective 6.3)
- Research collaborations between schools and universities, making children and classrooms across the state available to educational researchers
- Enhanced educational, training, or diagnostic services for students with special needs, their families, aides, and resource teachers

Objective 5.2: Explore the possibility of collaborating with existing Disaster Preparedness and Bio-Terrorism initiatives across the state to coordinate emergency communication and clinical care networks. Collaborate with current initiatives already underway (where possible) at public health departments and community health centers.

Other states have effectively used existing telehealth networks to enhance disaster recovery plans and provide enhanced "first response" capabilities.

GOAL 6: Support the development of new health care services, targeted at areas of high need, through new funding and coordination efforts.

Objective 6.1: Support efforts to simplify the negotiation and setup process for new telemedicine or telehealth specialty providers, especially small independent providers.

Resources needed to establish connections, install equipment, and make contractual arrangements with primary care offices or hospitals can be daunting to small-scale providers. This, along with inconsistent payer support, has tended to keep small specialty providers out of the telemedicine market. Making consulting services and equipment grants or loans available to these providers will help more of them consider entering the telemedicine market.

Objective 6.2: Develop or expand health educational programs that can be delivered via videoconferencing to schools or health clinics.

Topics for these programs could include chronic disease management, smoking prevention/cessation, healthy pregnancy, parenting support for single parents, etc. The Vision Athena network in its current state could support such educational offerings originating at one or more provider sites in Indianapolis and including many schools in urban and rural districts. If it is possible to upgrade the Vision Athena network to handle IP traffic (see Objective 5.1) many more potential origination and end user sites could be added. Meanwhile, IHETS can currently support transcoding of video traffic to enable non-compatible sites to participate in connections to the private network.

Objective 6.3: Develop 1-3 school-based telemedicine clinics.

In such clinics, school nurses provide onsite management while physicians or physician extenders (physician assistants and nurse practitioners) perform exams and write prescriptions

via telemedicine. If coupled with some local capacity for isolation of infectious students, such school-based clinics can provide a valuable service for working parents and students in high need areas. It is recommended that these programs collaborate with university-based telehealth research programs to identify best practices, evaluation strategies, and potential funding sources for these projects.

Objective 6.4: Develop or support 1-3 model implementations of virtual primary care clinics focused on improving access for minority populations.

Physicians and other health care professionals anywhere in the state can provide culturally competent primary care to patients in one or more rural provider shortage areas through telemedicine connections with local rural health clinics. These clinics could be arranged through contracts that entice existing culturally competent clinics to expand into providing telemedicine services or by supporting the development of new programs to hire clinicians to provide telemedicine care from their current location. Federally qualified health clinics (FQHCs) may have access to enhanced Medicaid reimbursement for some of these services.

Objective 6.5: Promote efforts to connect sophisticated diagnostic facilities at rural hospitals (echocardiogram, electroencephalogram, sleep centers, etc.) with qualified specialists in other communities.

There are several CAHs with sophisticated diagnostic facilities that are in demand but underutilized because of lack of access to qualified specialists. Arrangements to perform and deliver clinical studies to these specialists for remote review and consultation could be encouraged through the development of a statewide “rural health specialist exchange” system. Such a system would recruit specialists and connect them with hospitals and other facilities that need their expertise and are willing to make contractual arrangements to provide these specialties via telemedicine.

Objective 6.6: Explore options for providing remote IS/IT management and consulting services for Critical Access Hospitals and other rural providers, similar to what the Illinois Critical Access Hospital Network provides.

This type of concrete technical support may be highly valued by some independent CAHs, especially those that have no affiliations or are considering significant IS/IT purchases or expansion projects.

Objective 6.7: Continue to explore the use of telehealth technologies in Indiana correctional facilities.

Further projects could build on lessons learned from the pilot project with the Lugar Center for Rural Health and the Vigo County Correctional Facility. Projects should research and collect benchmark data from other national programs that provide telemedicine services to correctional facilities. These applications hold the promise to increase statewide awareness for the technology and strengthen telehealth policy because of the potential for dramatic cost savings.

CONCLUSION

This report highlights a number of potentially exciting developments that promise to bring enhanced healthcare services to Indiana's rural residents. Through a variety of programs, services, and systems, these developments will improve the health and quality of life of many Hoosiers.

A central theme of this report has been the importance of collaboration across many agencies, organizations, and business sectors if the full benefit of the health technology developments outlined here are to be realized for the greatest number of people.

Indiana stands in a somewhat unique position with regard to its healthcare infrastructure. Resources of tremendous value exist adjacent to large pockets of unmet need. The tools to bridge the spans that currently separate Indiana's healthcare resources from those with the greatest needs are gradually coming within reach. The tools involve the effective and appropriate use of technology, the development of novel and innovative service delivery models, and creative application of the skills and methods already at the disposal of Indiana's healthcare professionals. Most of all, however, using these tools effectively will demand that stakeholders from a variety of domains work together to operate them. These are tools with many handles, and a single group or organization cannot wield them effectively.

It is hoped that the resources and recommendations provided in this report will motivate and enable some of the work that will bridge the span leading to a healthier future for Indiana.

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Appendix A

Clarian Health

Clarian Educational Conferences

Title	Monday	Tuesday	Wednesday	Thursday	Friday	Time	Frequency	CME
Cardiology Case Review						12:00-1:00 PM	Monthly 1st Thu	NO
Clarian EMS Audit and Review						7:00-9:00 PM	Monthly 3rd Tue	EMS Credit
Internal Med Morning Rounds						8:30-9:30 AM	Weekly	NO
Internal Med Noon Rounds						12:00-1:00 PM	Weekly	
IU Breast Cancer Conference						7:00-8:00 AM	Weekly	NO
IU Cancer Grand Rounds						7:30-8:30 AM	Weekly	YES
Methodist Sleep Study Case Review						6:00-7:00 PM	Monthly	NO
Palliative Care Grand Rounds						11:30-12:30 PM	Weekly	YES
Pediatric GI/Path Conference						9:00-10:00 AM	Monthly	NO
Riley Cardiac Cath Case Review						7:00-8:00 AM	Weekly	NO
Riley Cardiac MRI Review						12:30-1:30 PM	Monthly 1st Wed	NO
Riley NICU Conference						8:15-9:15 AM	Weekly	YES
Riley Pediatric Grand Rounds						8:00-9:00 AM	Weekly	YES
Riley Pediatric Tumor Board						2:30-3:30 PM	Weekly	YES

For More Information Please Contact
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Clarian Telemedicine
317-278-0195
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Appendix B

Indiana Critical Access Hospitals with RUCA Scores

Bedford Regional Medical Center (CAH)
2900 W. 16th Street
Bedford, IN 47421
RUCA Primary = 4
RUCA Secondary = 4.2
County Code = 093
Census Tract = 9508

Dunn Memorial Hospital (CAH)
1600 23rd Street
Bedford, IN 47421
RUCA = 4
RUCA Secondary = 4.2
County Code = 093
Census Tract = 9511

Bloomington Hospital of Orange County (CAH)
642 W Hospital Road
Paoli, IN 47454
RUCA Primary = 10
RUCA Secondary = 10
County Code = 117
Census Tract = 9514

Decatur County Memorial Hospital (CAH)
720 North Lincoln Street
Greensburg, IN 47240
RUCA Primary = 4
RUCA Secondary = 4.0
County Code = 031
Census Tract = 9693

Rush Memorial Hospital (CAH)
1300 N. Main Street
Rushville, IN 46173
RUCA Primary = 7
RUCA Secondary = 7.4
County Code = 139
Census Tract = 9744

Gibson General Hospital (CAH)
1808 Sherman Drive
Princeton, IN 47670
RUCA Primary = 7
RUCA Secondary = 7.3
County Code = 051
Census Tract = 0505

St. Mary's Warrick Hospital (CAH)
1116 Millis Avenue
Boonville, IN 47601
RUCA Primary = 2
RUCA Secondary = 2.0
County Code = 173
Census Tract = 0306

Harrison County Hospital (CAH)
245 Atwood Street
Corydon, IN 47112
RUCA Primary = 7
RUCA Secondary = 7.1
County Code = 061
Census Tract = 0604

St. Vincent Clay Hospital, Inc. (CAH)
1206 East National Avenue
Brazil, IN 47834
RUCA Primary = 4
RUCA Secondary = 4.2
County Code = 021
Census Tract = 0402

West Central Community Hospital (CAH)
801 S. Main Street
Clinton, IN 47842
RUCA Primary = 7
RUCA Secondary = 7.1
County Code = 165
Census Tract = 0205

Jasper County Hospital (CAH)
1104 East Grace Street
Rensselear, IN 47978
RUCA Primary = 7
RUCA Secondary = 7.0
County Code = 073
Census Tract = 9912

Woodlawn Hospital (CAH)
1400 East 9th Street
Rochester, IN 46975
RUCA Primary = 7
RUCA Secondary = 7.0
County Code = 049
Census Tract = 9531

Parkview LaGrange Hospital (CAH)
207 N Townline Rd
LaGrange, IN 46761
RUCA Primary = 7
RUCA Secondary = 7.0
County Code = 087
Census Tract = 9702

Cameron Memorial Community Hospital (CAH)
416 East Maumee Street
Angola, IN 46703
RUCA Primary = 4
RUCA Secondary = 4.0
County Code = 151
Census Tract = 9714

Community Hospital of Bremen, Inc. (CAH)
1020 High Road
Bremen, IN 46506
RUCA Primary = 7
RUCA Secondary = 7.3
County Code = 099
Census Tract = 020101

Dukes Memorial Hospital (CAH)
275 W. 12th Street
Peru, IN 46970
RUCA Primary = 4
RUCA Secondary = 4.2
County Code = 103
Census Tract = 9522

Jay County Hospital (CAH)
500 W. Votaw Street
Portland, IN 47371
RUCA Primary = 7
RUCA Secondary = 7.0
County Code = 075
Census Tract = 9631

Perry County Memorial Hospital (CAH)
One Hospital Road
Tell City, IN 47586
RUCA Primary = 7
RUCA Secondary = 7.0
County Code = 123
Census Tract = 9525

Pulaski Memorial Hospital (CAH)
616 East 13th Street
Winemac, IN 46996
RUCA Primary = 7
RUCA Secondary = 7.0
County Code = 131
Census Tract = 9590

Wabash County Hospital (CAH)
710 N. East Street
Wabash, IN 46992
RUCA Primary = 4
RUCA Secondary = 4.0
County Code = 169
Census Tract = 9926

White County Memorial Hospital (CAH)
1101 O'Conner Boulevard
Monticello, IN 47960
RUCA Primary = 7
RUCA Secondary = 7.3
County Code = 181
Census Tract = 9586

Adams Memorial Hospital (CAH)
1100 Mercer Avenue
Decatur, IN 46733
RUCA Primary = 4
RUCA Secondary = 4.2
County Code = 001
Census Tract = 0303

Blackford Community Hospital (CAH)
410 Pilgrim Blvd
Hartford City, IN 47348
RUCA Primary = 7
RUCA Secondary = 7.0
County Code = 009
Census Tract = 9752

Green County General Hospital (CAH)
RR1, Box 1000
Linton, IN 47441
RUCA Primary = 10
RUCA Secondary = 10.6
County Code = 055
Census Tract = 9549

Margaret Mary Community Hospital, Inc. (CAH)
321 Mitchell Avenue
Batesville, IN 47006
RUCA Primary = 7
RUCA Secondary = 7.0
County Code = 137
Census Tract = 9685

Putnam County Hospital (CAH)
1542 Bloomington Street
Greencastle, IN 46135
RUCA Primary = 7
RUCA Secondary = 7.3
County Code = 133
Census Tract = 9563

Scott County Memorial Hospital (CAH)
1451 N. Gardner
Scottsburg, IN 47170
RUCA Primary = 4
RUCA Secondary = 4.0
County Code = 143
Census Tract = 9670

St. Vincent Frankfort Hospital (CAH)
1300 S. Jackson Street
Frankfort, IN 46041
RUCA Primary = 4
RUCA Secondary = 4.0
County Code = 023
Census Tract = 9508

St. Vincent Jennings Hospital (CAH)
301 Henry Street
North Vernon, IN 47265
RUCA Primary = 4
RUCA Secondary = 4.2
County Code = 079
Census Tract = 9604

St. Vincent Mercy Hospital
1331 South A Street
Elwood, IN 46036
RUCA Primary = 4
RUCA Secondary = 4.2
County Code = 095
Census Tract = 0102

St. Vincent Randolph Hospital (CAH)
473 Greenville Avenue
Winchester, IN 47394
RUCA Primary = 7
RUCA Secondary = 7.3
County Code = 135
Census Tract = 9517

St. Vincent Williamsport Hospital (CAH)
412 N. Monroe Street
Williamsport, IN 47993
RUCA Primary = 2
RUCA Secondary = 2.0
County Code = 171
Census Tract = 9510

Sullivan County Community Hospital
2200 N. Section Street
Sullivan, IN 47882
RUCA Primary = 7
RUCA Secondary = 7.3
County Code = 153
Census Tract = 0503

Tipton Hospital (CAH)
1000 S. Main Street
Tipton, IN 46072
RUCA Primary = 7
RUCA Secondary = 7.3
County Code = 159
Census Tract = 0204

Washington County Memorial Hospital
911 N. Shelby Street
Salem, IN 47167
RUCA Primary = 7
RUCA Secondary = 7.3
County Code = 175
Census Tract = 9675

***Year 2000 information obtained @:**
http://www.ers.usda.gov/Data/RuralUrbanCommutingAreaCodes/2000/RUCA18.xls

Appendix C

	Tele-Consultations													*Tele-Education*			*Critical Care*	
Indiana Health Care Providers	**Mental Health**	**Dermatology**	**Diabetes**	**Urology**	**Cardiology**	**Pulmonology**	**Oncology**	**OB/Gyn**	**Developmental**	**Neurology**	**Store & Forward**	**Home Health**		**Live Broadcasts**	**Web Based**		**ED /ER**	**eICU**
Clarian Health	√	√	√	√	√	√			√	√	√	√		√	√			√
St. Vincent	√									√	√	√		√	√			
Community Health Partners	√																√	
St. Francis								√										
Community Cancer Care	√						√											
Lugar Center for Rural Health	√										√							
Parkview Health																		√
VA Medical Center	√		√								√	√						
Nightingale Home Healthcare												√						
Center for Behavioral Health	√																	

* List includes only heatlh care providers that act as Hub site for telehealth networks, and does not include recipient (spoke) sites

** Store & Forward applications may include the transfer of clinical files such as EEG's or Echo's and does not include general tele-radiology
*** Only live 2-way video consultations are included under Tele-Consultations